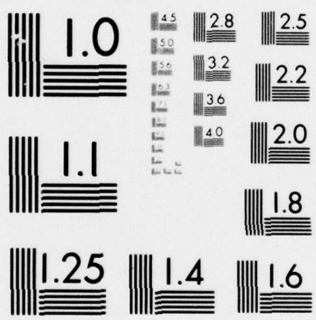
AD-A038 841 NAVAL WEAPONS HANDLING CENTER COLTS NECK N J F/G 13/4
RAIL IMPACT TEST OF AN INTERNAL RESTRAINT SYSTEM FOR COMMERCIAL--ETC(U)
DEC 76 F G CICCOLELLA
UNCLASSIFIED NWHC-7695 NL

| OF |
AD
A038841

END
DATE
FILMED
5—77



MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS-1963-A

12

NWHC REPORT 7695
3 DECEMBER 1976

A NAVAL WEAPONS HANDLING CENTER

TECHNICAL REPORT

RAIL IMPACT TEST OF AN INTERNAL RESTRAINT SYSTEM FOR COMMERCIAL ISO CONTAINERS

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.

NAVAL WEAPONS STATION EARLE
Colts Neck, New Jersey 07722

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. ~~REPORT NUMBER~~ (14) NWHC-7695	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. ~~TITLE (and Subtitle)~~ (6) Rail Impact Test of an Internal Restraint System for Commercial ISO Containers.		5. ~~TYPE OF REPORT & PERIOD COVERED~~ (9) Final rept.
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) (10) F. G. Ciccolella		8. ~~CONTRACT OR GRANT NUMBER(s)~~ N/A
9. ~~PERFORMING ORGANIZATION~~ NAME AND ADDRESS Naval Weapons Station Earle Weapons Handling Center Colts Neck, New Jersey 07722		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Sea Systems Command SEA-06G3 Washington, D. C.		12. ~~REPORT DATE~~ (11) 3 Dec[redacted]76
		13. NUMBER OF PAGES 16
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)* (12) 17p.		15. SECURITY CLASS. *(of this report)* UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

ACCESSION for		
NTIS	White Section	☑
DDC	Buff Section	☐
UNANNOUNCED		☐
JUSTIFICATION		
BY		
DISTRIBUTION/AVAILABILITY CODES		
Dist.	AVAIL. and/or SPECIAL	
A		

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Concept
Internal Restraint System
Ammunition Loads
Rail Impact Test
Commercial ISO Containers

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report describes rail impact tests conducted upon a concept of an Internal Restraint System Kit to secure dense ammunition loads in a commercial ISO container. The results of the tests indicate this concept can satisfactorily restrain the load within the container.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

410 058

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

NWHC REPORT 7695
3 December 1976

RAIL IMPACT TEST
OF AN
INTERNAL RESTRAINT SYSTEM
FOR
COMMERCIAL ISO CONTAINERS

Abstract

This report describes rail impact tests conducted upon a concept of an Internal Restraint System Kit to secure dense ammunition loads in a commercial ISO container. The results of the tests indicate this concept can satisfactorily restrain the load within the container.

Prepared by: F. G. Ciccolella
F. G. Ciccolella
Surface Warfare Systems

Reviewed by: S. R. Petoia
S. R. Petoia
Surface Warfare Systems

Approved by: R. E. Seely
R. E. Seely
Test & Evaluation Division

INTRODUCTION

The system herein described was developed for the purpose of restraining dense ammunition loads in 8' X8' X20' commercial ISO containers. This system, the latest in a series of design concepts, evolved from observations and data derived from prior concepts which are formally described in NWHC Reports 7516, 7537, 7565, 7590, 7613 and 7645. The rail impact tests described herein were conducted on 28 October and 5 November 1976.

THE TEST CONTAINER

The container used in this test was a STRICK "ARMORPLATE", S/N CORU 220118-8 a commercial intermodal container meeting ISO standards. The floor of the container is a wood surface secured to steel channels and I beams, and the walls were steel sheathed with 1/4" plywood. Twelve loads of thermally coated Bombs Mk 82 palletized on MHU-122/E Pallets were used to represent a typical load of dense ammunition shipment. The loads are restrained within the container by a tie-down system consisting of two 5/8" diameter steel wire rope assemblies with swaged eyes, a hold down tube, and 2" X .050 steel strapping. In addition, a wooden end gate, floor stringers and center sway braces are used. Steel strapping attachments are made to the container floor while the wire rope cables are secured through the corner posts at a point just below the upper corner fittings at the closed end of the container (Figures 1 and 2).

The container required a modification prior to loading which consisted of drilling two 7/8" diameter holes through the two forward corner posts (closed end of the container) to accommodate the terminal connectors of the two wire rope cable assemblies. The cables were secured to the corner post from the outside via locknuts.

The other two ends of the securing cables were passed through the corresponding holes in the aluminum hold down tube (see figure 1 and 6). A load cell, for test purposes, was inserted in series with one of the securing cables to measure shock loads. (See Figure 5). Adapting hardware secured the load cell through the remaining hole in the hold down tube. The tube (1/2" wall, 7" dia., aluminum) was secured by four 2"X.050" steel strappings anchored to the floor beneath the bomb loads. (See Figure 2). The nuts on the wire rope assemblies were tightened against the hold down tube, applying tension to both the steel strapping and wire rope assemblies; and to tighten the tube against the load.

Figures 1 and 3 show the loaded ISO container with the restraint system properly tensioned and ready for test. The load data are listed in Table I.

TEST PROCEDURE

The test container, loaded as indicated, was placed on one end of a 90 foot TTCX railway flatcar, SN 976080. This car is equipped with a cushioned drawhead and has special tie-down provisions to secure ISO containers to the car bed. This car is referred to as the impact car in the following description.

A string of five stationary empty boxcars coupled together without slack in the draft gears, and brakes "set" was used as a buffer. Total weight of the buffer cars was 260,000 pounds.

The impact car was propelled toward the buffer cars by a locomotive. At the approximate desired impact velocity, the car was released from the locomotive and allowed to roll freely for about 75 feet and impact into the buffer string. The official test procedure, MIL-STD-1325 "Railcar Loading of Hazardous Materials" calls for three impacts on one end of the impact car at velocities of 4, 6 and 8 MPH. The car is then reversed and a single impact is made at 8 MPH on the opposite end. Two impacts at 10 MPH, one on each end, were added to the test program. This was done in order to determine the safety factor inherent in this IRSKIT concept.

The actual velocity of impact is determined by two microswitches installed at each end of an 11 foot section of track immediately before the point of impact. The microswitches, actuated by the leading wheels of the impact car, activate an elapsed time recorder reading in milliseconds. The feet per second readings are then converted to velocity in miles per hour. The actual impact velocities and buffer car movements on the impacts are listed in Table II. The doors of the loaded ISO container had been secured in their fully opened position so load movement could be observed on each impact. Figure 4 was taken subsequent to the impact at 10.3 mph. Additionally, accelerometers were mounted on the container floor and on the bomb load. Figure 1 depicts these locations and the floor accelerometer is visible in Figure 3.

Instrumentation was installed for the purpose of developing procedures and techniques for data acquisition in restraint system testing. Since this was the initial effort, there is no previous data to which comparisons can be made.

The data and instrumentation is listed on Table II.

TEST RESULTS

The TTCX flatcar, the ISO container, the restraint system and the bomb loads were inspected after each impact for damage or loss of load integrity. The four impacts which constitute an "official" rail impact test resulted in negligible shifting of the bomb loads, and no damage or loss of load integrity occurred. Actual velocities attained, and other acquired data, are shown in Table II. The bombs and the internal restraint system remained intact and undamaged after all impacts had been completed.

Subsequent to the required tests, the first of the added tests (impact #5) was conducted with no degradation of the load or restraint system. Minor shifting in the amount of 3/8" occurred to the load; however, this was not in excess of what had occurred during the first 8 mph (actual 9.1 mph) impact on the door end and reflects the overall amount of "looseness" to the system.

On 5 November 1976 the second of the two added tests (impact #6) was conducted. In addition, the door end test (impact #7) was conducted. This was a repeat of the first of the two added tests (impact 5).

They were nominally done at 10 mph (actual velocities 9.9 and 10.3 mph). No problem resulted and no additional movement of the load took place. This data and the data obtained on 28 October 1976 which was beyond the scope of the required tests, are also shown in Table II.

CONCLUSIONS

This internal restraint concept satisfactorily withstood the rail impact test requirements of MIL-STD-1325, and completed three additional impacts at a nominal speed of 10 mph without suffering degradation to the restraint system or the load of bombs. The results of the extra impacts indicate this IRSKIT concept is as reliable as the container in this type of test.

RECOMMENDATIONS

The system has been tested and has successfully passed the required tests, however, it is recommended that the following refinements be made to the system.

A. While the aluminum tube satisfactorily restrained the load, efforts should be made to simplify the system to either reducing the size (of the tube) or perhaps eliminate the requirement for the aluminum tube. Accomplishment of this recommendation would both reduce the overall costs of the system/kit and also further simplify the loading procedure.

B. The restraint cable terminal fittings which pass through and are secured to the container corner posts should be refined to preclude

or minimize protrusion of any hardware beyond the container envelope dimensions. The extent to which such protrusion can exist is a function of tolerances between the container and containership cell guide dimensions. Accordingly, a study should be conducted to determine dimensional constraints and maximum permissible terminal hardware dimensions beyond the cornerpost external wall.

C. Further testing should be done with the existing restraint system as tested and reported upon herein utilizing other loads, i.e. projectiles, boxed ammunition, etc., to demonstrate universality of the "kit".

LOAD DATA

Unit Load	12 ea MHU-122/E Pallets of Mk 82 Mod 2 Bombs	37,980 lbs
Wood Dunnage and 10d Nails	2 X 4's, 2 X 6's 2 X 8's	200 lbs
Steel Strapping	2" X .050	50 lbs
Hold Down Tubes	1 ea 7" Diameter Aluminum	75 lbs
5/8" dia. wire rope	2 ea. @ 15	30 lbs
Turnbuckle Assy's	2 ea. @ 10#	20 lbs
	Load Weight	38,355 lbs
	Container Tare Weight	4,840 lbs
	Gross Loaded Weight	43,195 lbs

TABLE I

RAIL IMPACT TESTS
STRICK "ARMORPLATE" S/N CORU-220118-8 ON TTCX 976080
28 OCTOBER 1976

IMPACT	ACTUAL MPH	BUFFER CAR MOVEMENT	LOAD CELL	ACCELEROMETERS FLOOR	ACCELEROMETERS BOMB LOAD
1. "B" end (door)	4.8	1"	3,910#	-	-
2. "B" end (door)	7.1	9"	-	-	-
3. "B" end (door)	9.1	39"	13,040#	-	-
4. "A" end (closed)	9.0	32"	-	-	-
Completion of MIL-STD-1325, "Railcar Load of Hazardous Materials" test requirements. The following impacts are above and beyond these requirements.					
5. "B" end (door)	9.8	62"	-	-	-
ADDITIONAL IMPACTS 5 NOVEMBER 1976					
6. "A" end (closed)	9.9	43"	10,220#	1.8g's	-
7. "B" end (door)	10.3	52"	14,990#	1.9g's	-

INSTRUMENTATION LISTING:

Load cell, 25,000 lb. rating.
Accelerometer, floor Statham A5a-15-300.
Accelerometer, bomb load Statham A5a-5-350
PEMCO portable tape recorder, Model 110
Data processed thru a Sangamo Model 4700 tape recorder and Sanborn Model 850 hot pen recorder.

TABLE II

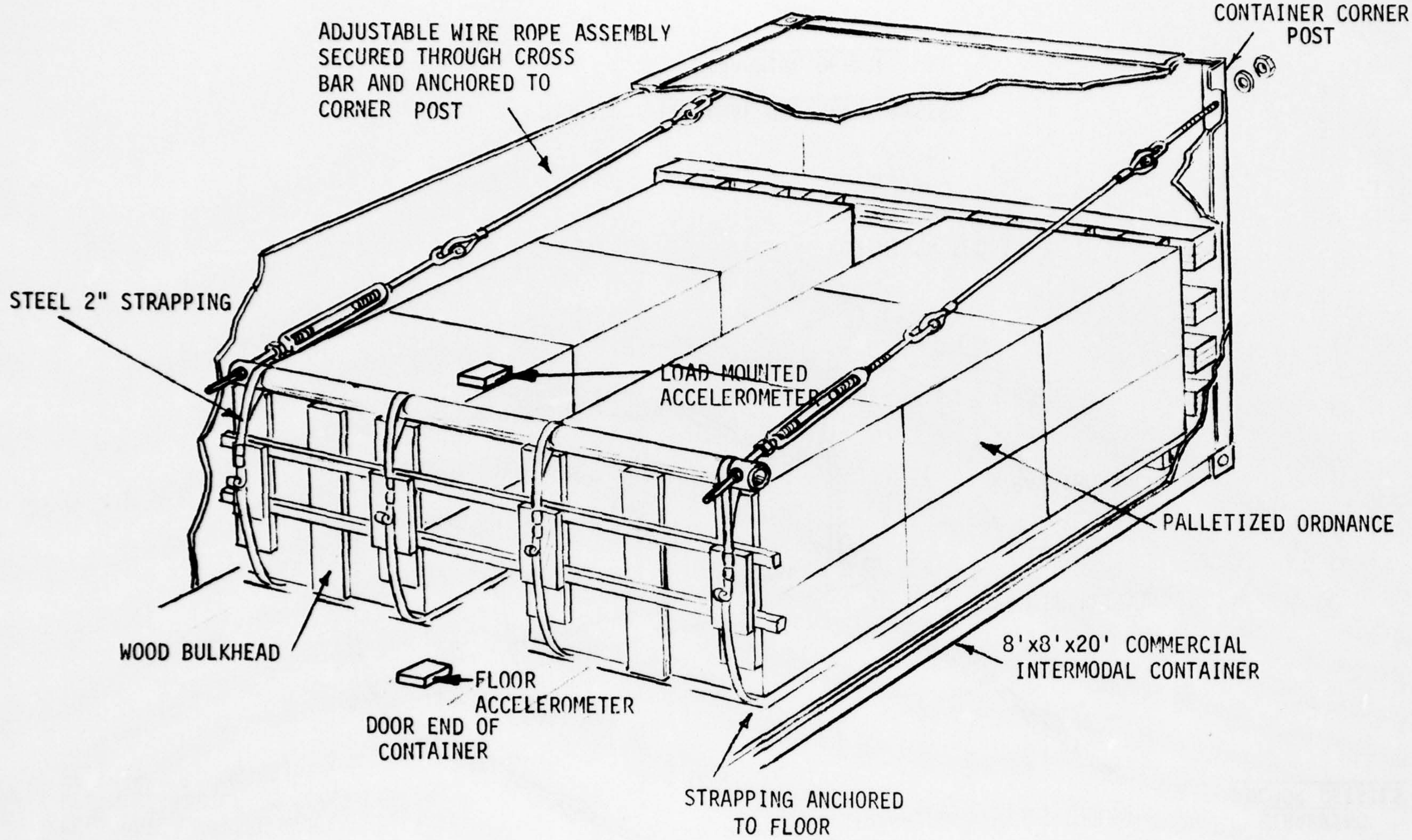


FIGURE 1 INTERNAL RESTRAINT SYSTEM
(SIDE BRACING - CORNER POST ANCHORING)

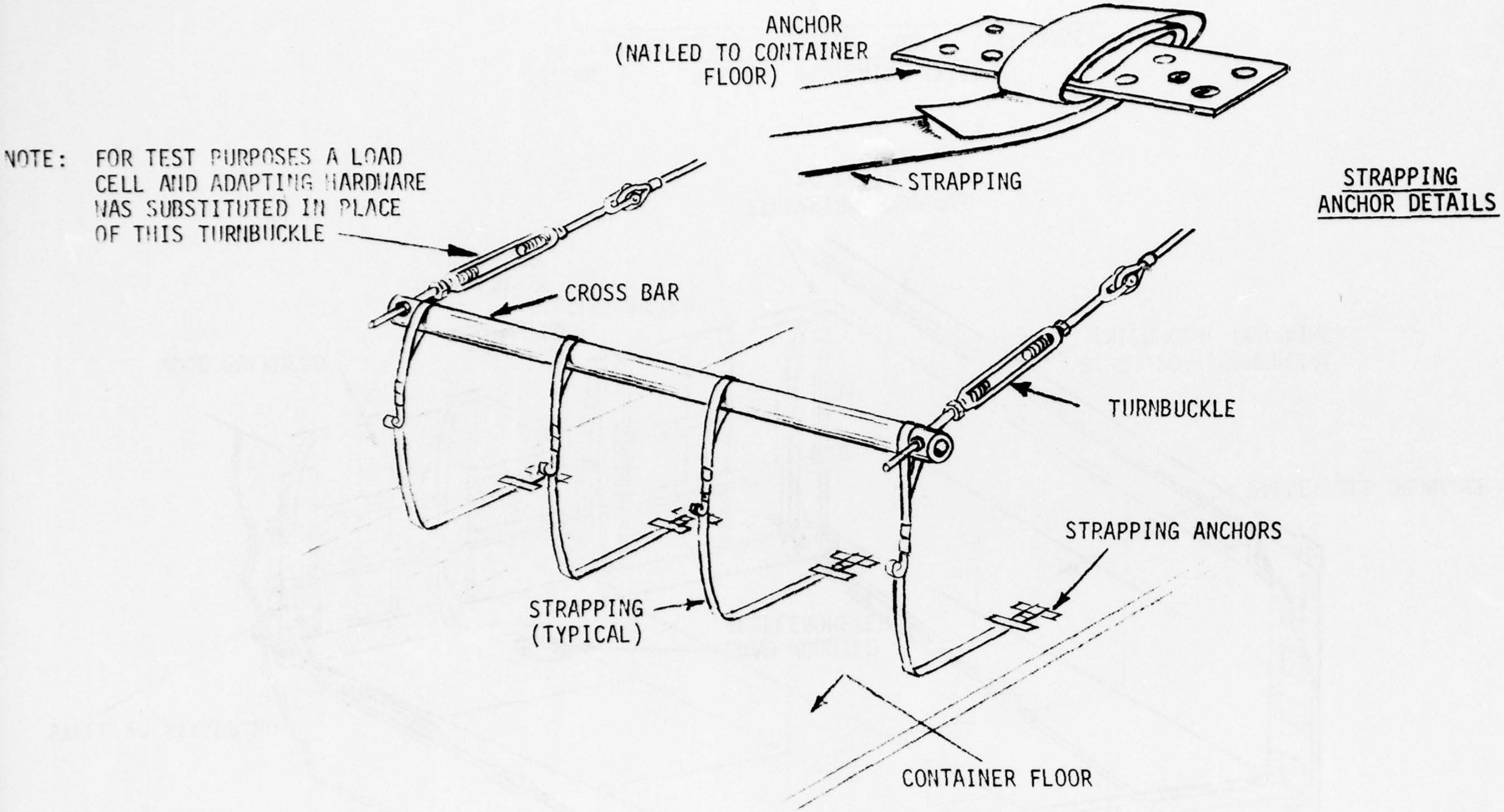


FIGURE 2 INTERNAL RESTRAINT SYSTEM

STRAPPING DETAILS

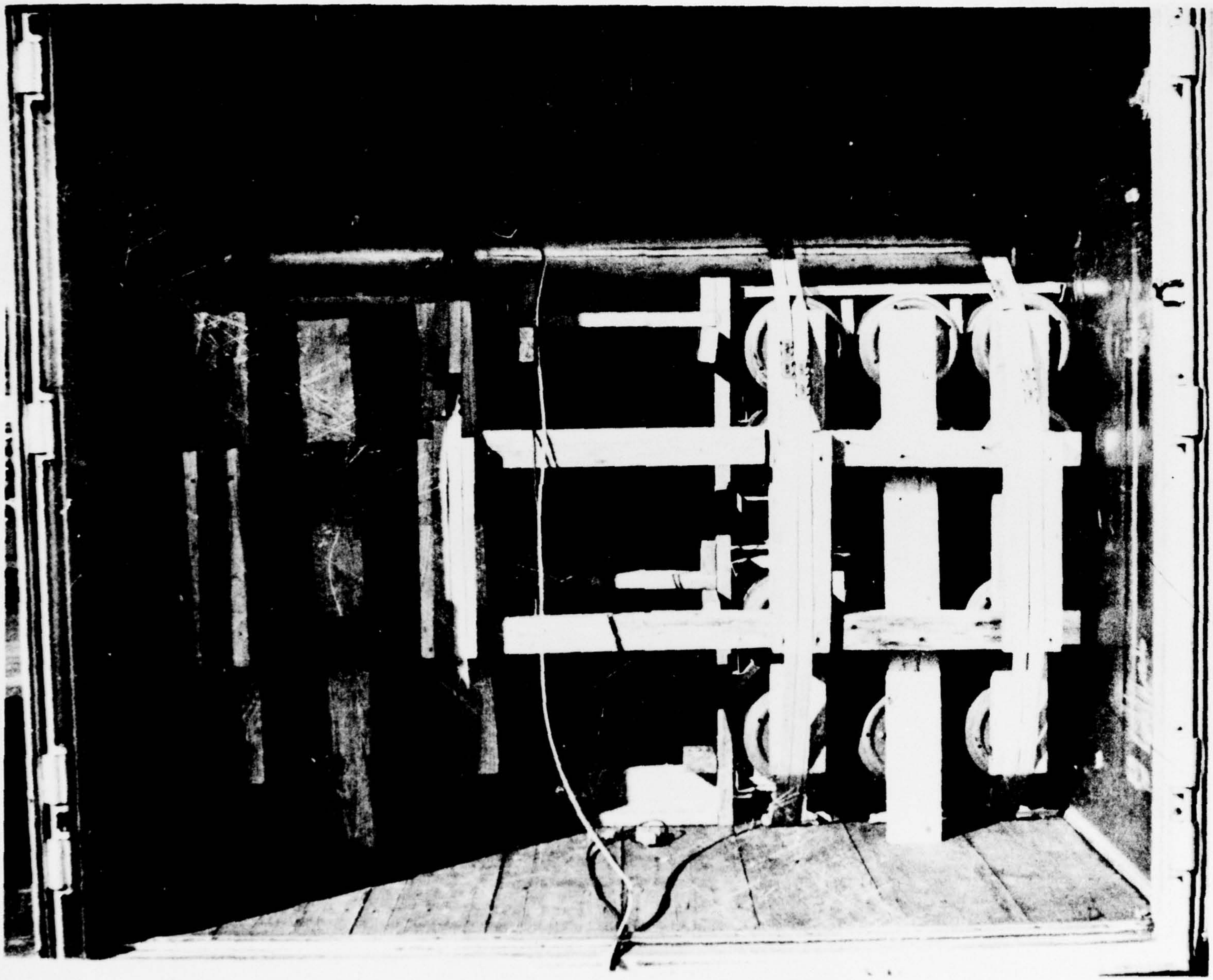


FIG. 3 TEST CONTAINER ON TTCX FLATCAR PRIOR TO TESTING.

FIG. 4 TEST CONTAINER ON TTCX FLATCAR DURING TESTING - PHOTO TAKEN SUBSEQUENT TO IMPACT AT 10 MPH.

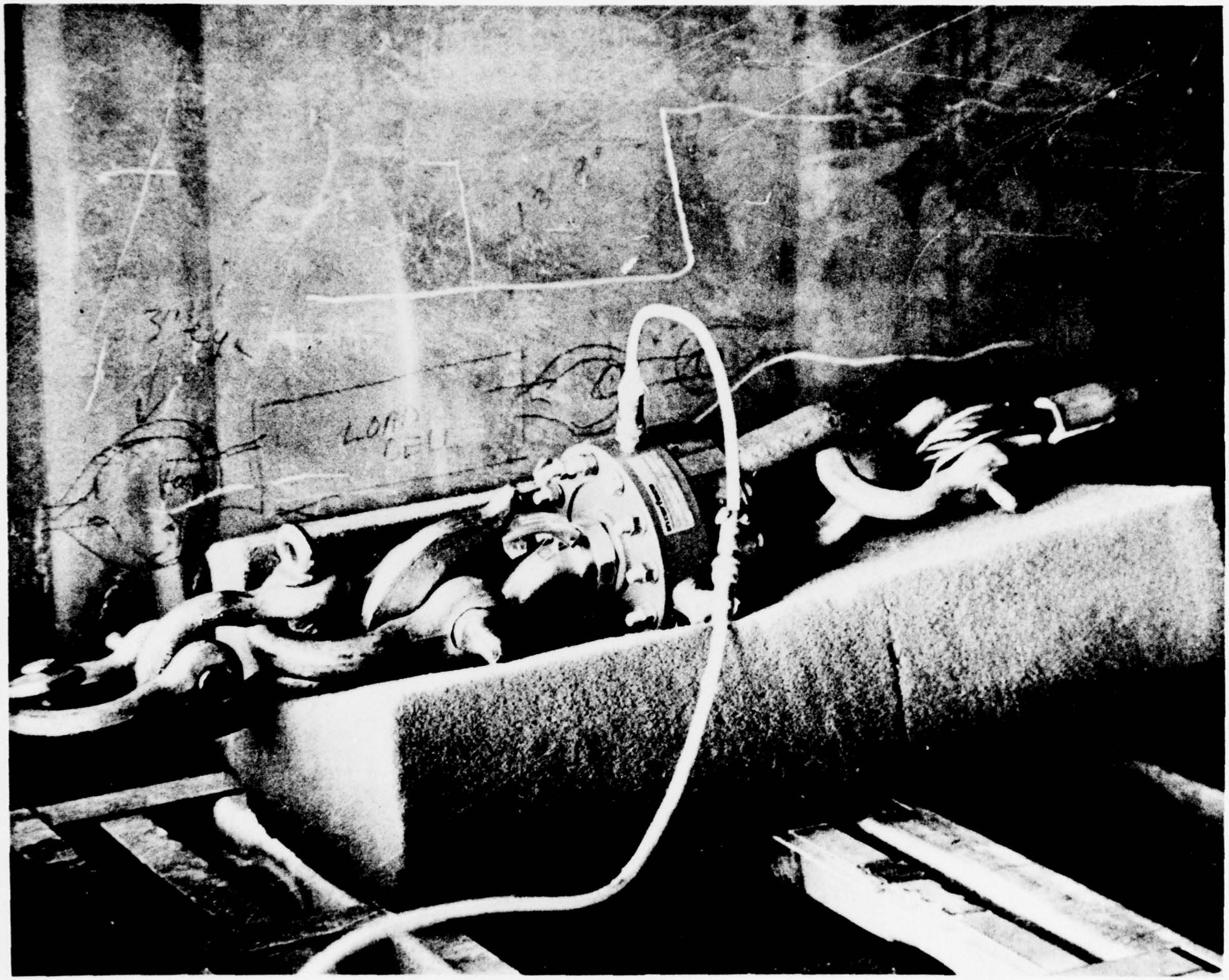


FIG. 5 LOAD CELL INSTALLED ON LEFT RESTRAINT CABLE.

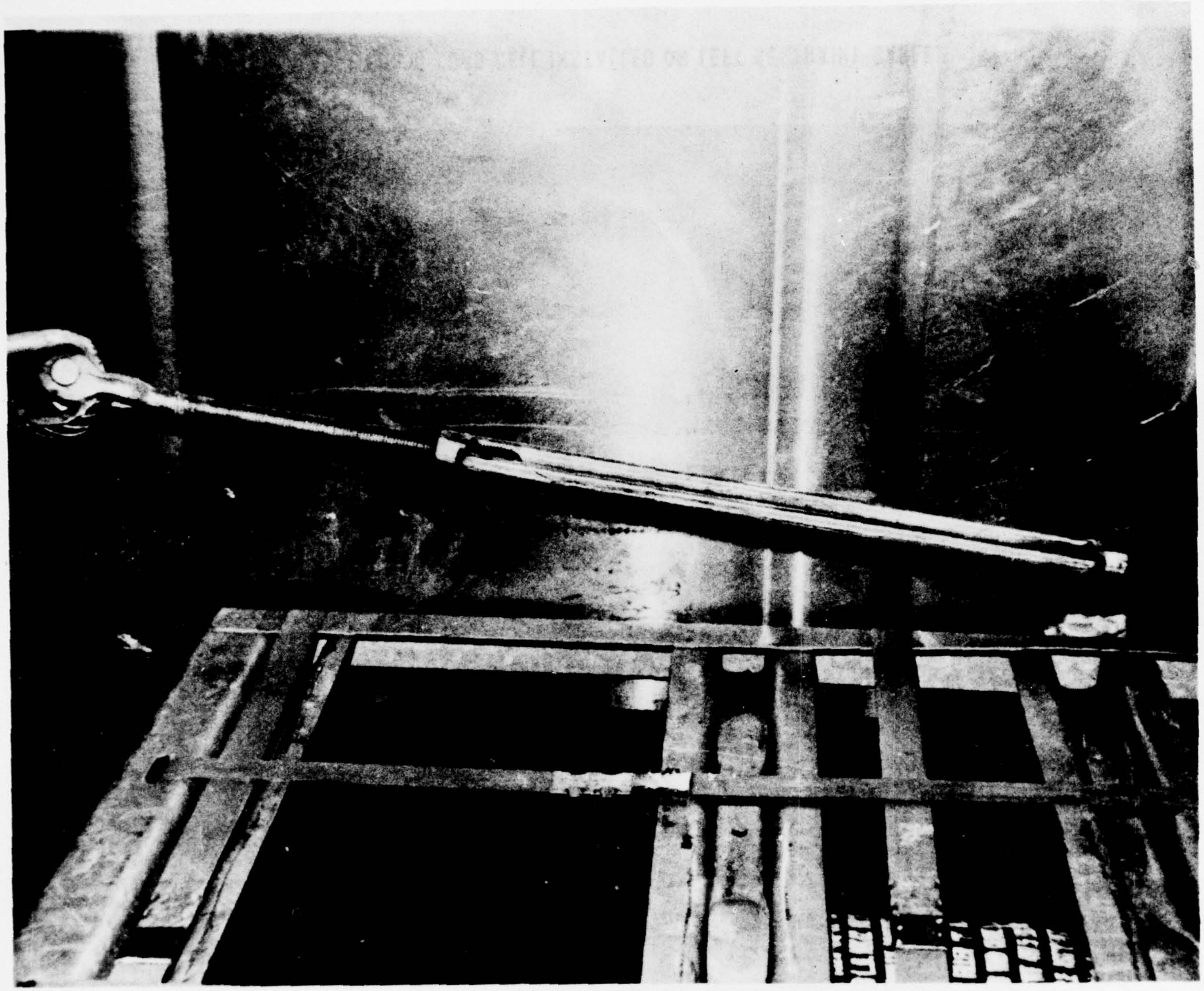


FIG. 6 TURNBUCKLE INTERFACING BETWEEN RIGHT RESTRAINT CABLE AND TUBE.